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Submission to FSANZ on Call for Submissions – Low THC Hemp Seeds as Food

FSANZ Proposal P1042

Summary of Submission

Since establishing in 1998, Agri Fibre Industries (AFI) has become Australia's most successful breeder of industrial hemp. With multiple PBR protected varieties for hemp food, AFI anticipates being a primary supplier of seed to the Australian industry, and to show leadership in the development of a high standard domestic and export-focused food industry based on industrial hemp seed.

AFI's submission has focused on the concerns of the Australia and New Zealand Ministerial Forum on Food Regulation, its requirements for low THC levels in food and concerns surrounding marketing and law enforcement; AFI supports the majority of FSANZ's findings related to use of hemp seed as a food, and notes FSANZ long-term support for allowing hemp seed to be used as a food.

AFI believes that the advent and approval of medicinal cannabis in Australia has dramatically changed the public view of hemp away from drug use and towards healthy human outcomes. This is fully consistent with overseas approaches to hemp seed, where its health benefits are its major selling points and drug inferences strongly detract from this message. AFI believes this is also key to Australian and New Zealand governments accepting that the general public is now mature in its understanding of hemp plant benefits, and is ready for hemp food.

AFI puts forward an offer to develop an industry code of practice. Firstly, to ensure the marketing of hemp food remains focused on defensible health benefits and does not infer any association with drug use. Secondly, to ensure best practice with seed handling through washing, which has been demonstrated as highly effective in delivering hemp food products with very low THC content.

Finally, addressing the issue of roadside drug testing was noted as outside of FSANZ jurisdiction. AFI has also noted that roadside drug testing based on absolute detection, rather than levels of driver impairment, is problematic now in court and likely to become more problematic with the advent of medicinal cannabis. AFI advocates that a functioning and stable law enforcement policy is pursued through a focus on driver impairment levels, and that the very low levels of THC that are present in hemp food will not be problematic within this framework.

Background

The following submission is made on behalf of Agri Fibre Industries (AFI), a company established in 1998 and having the largest and most successful industrial hemp breeding program in Australia.

AFI has Australian Plant Breeders Rights (PBR) granted for 6 breeds and accepted for 1 further breed of the 12 registered varieties in Australia. Most of these breeds have been developed for a hemp food industry in Australia, leveraging hemp's outstanding nutritional profile. AFI further seeks to leverage Australia's leading capability in agriculture, and looks towards a sizeable future industry built on value added products manufactured in regional Australia. AFI is positioning to supply the largest volume of viable seed to Australian farms, and therefore be central to the whole industry in the provision of low-THC industrial hemp plants for a food industry. AFI therefore has a significant interest in adopting best practices, showing industry leadership and fostering the development of a high standard domestic and export-focused food industry based on industrial hemp seed.

As a company that has invested substantially in the development of hemp foods since its inception, and has considerable interest in seeing the establishment of a legitimate and high quality hemp food industry within Australia, we believe our submission outlines Australia's major commercial interests in the growing and supply of hemp seed for the food industry, and illustrates how an undertaking by Australia's future hemp food industry will address concerns raised by the Australia and New Zealand Ministerial Forum on Food Regulation (the Forum).

Support of FSANZ Proposal

AFI wishes to make clear its agreement and support of FSANZ in the following areas as documented in P1042:

- That hemp seed is safe as a food under specified maximum limits (MLs) of THC
- Sale of hemp seed to the public should be in a non-viable, dehulled form
- Processors of hemp seed for subsequent food consumption may require access to viable whole seed, and a regulatory process should be established for this purpose
- Hemp seed should be sourced exclusively from registered *Cannabis sativa* crops.
- That there is no requirement to enforce a CBD limit in food due to its very low natural presence in seeds and this level being substantially below therapeutic dose
- That hemp seed should not be enhanced with product from any other part of the Cannabis plant including cannabinoids
- That THC reporting be recorded as a total of THC + THC-A, and that limits are set for total THC for hemp foods

AFI is happy to further detail its support of the FSANZ proposal as requested by FSANZ or the Forum. Further specific responses of AFI are listed below by topic.

Schedule 23 Listing of Cannabis

AFI notes the listing of Cannabis in Schedule 23 of the ANZ Food Standards Code as a prohibited plant. AFI also notes the concern of the Forum that the use of a product from the Cannabis plant may send mixed signals to the community on the illicit use of Cannabis.

AFI would therefore like to highlight the treatment of Cannabis in the UN Single Convention on Narcotic Drugs (SCND), to which Australia is a signatory. The SCND specifically excludes the seeds from the definition of Cannabis for the purpose of the Convention, and states in Article 28

This Convention shall not apply to the cultivation of the cannabis plant exclusively for industrial purposes (fibre and seed) or horticultural purposes.

We highlight this point to illustrate that, in its wording, the SCND authors have drawn a line between the illicit use of drugs and the industrial use of hemp seeds. This is one basis on which we believe that use of hemp seeds is considered internationally as wholly separate and distinct from illicit drug use, and that there is no concern in other countries that provision of hemp food will send a mixed message to consumers on the acceptability and safety of cannabis, and in particular foster its illicit use.

We therefore advocate that hemp seeds are not included within Schedule 23 of the ANZ Food Standards Code.

Marketing of Hemp Foods

The Forum has raised concerns on the potential for branding and marketing material associated with hemp food to infer illicit drug use.

AFI, like many businesses looking to grow hemp seed, is focused on a market promoting healthy food and healthy lifestyle. It is incongruous for any of these companies to send mixed messages, and we have no trust that any substantive market exists for a product which is sold on drug associations and yet has no drug content. Therefore AFI can strongly state that it has no market or monetary advantage in associating its product with illicit drugs.

AFI accepts FSANZ's position that it is not within the power or brief of FSANZ to recommend marketing restriction guidelines, and that various laws are present which prevent false advertising of benefits or effects of a food product, and that labelling laws help to bring focus to the actual food content of such products.

However, in recognition that existing concerns of the Forum may not be addressed by this response, AFI is happy to lead the development of a voluntary industry code of practice for all future vendors of hemp foods, to be finalised within 12 months of approval and gazetting. This code will address as a minimum the following matters:

- No use of stylised or actual Cannabis leaf in any marketing material
- No inferences of psychotropic effects from use or ingestion
- No use of words associated with marijuana
- No use of language associated with illicit use of Cannabis (e.g. use of words or derivatives of stone, high, weed and joint)
- No use of the word Cannabis except as legally required
- No statement of benefits of hemp food consumption outside of proven facts

AFI is ready to make further submissions to the Forum or other concerned bodies on how to refine this code and ensure that the hemp food industry commences and continues to promote foods with no inferred link to illicit drug use.

Provision of Low THC Level Foods

FSANZ has identified that THC exposure under a suggested maximum level (ML) would be an adequate prerequisite for safe consumption of hemp seed. Through our own research and

supported in published documents[1,2], AFI has identified that handling practice (and carrying of THC material on the outer seed surface) has some influence on the level of THC found in processed seeds, producing variability in measured THC albeit at a low level.

AFI wholeheartedly promotes that good handling practice can dramatically reduce the level of THC in seed and derived products, and make such products exceptionally safe for consumption. AFI intends establishment of washing processes within its own facilities to minimise the level of surface THC in line with world's best practice. As well, AFI is again ready to help develop a voluntary code of practice for all future vendors of hemp foods, to be finalised within 12 months of approval and gazetting. This code will address as a minimum the following matters:

- The implementation of standard washing procedures for seed designated for food use
- The implementation of standard batch testing procedures for THC content

AFI is ready to make further submissions to the Forum or other concerned bodies to refine this code and ensure that the hemp food industry commences and continues to provide food products with levels of THC consistent with its food product status.

Concerns on Interference with Law Enforcement

Concerns have been raised by the Forum that there will be impacts on law enforcement based on the presence of trace amounts of THC in food.

In making the current submission, AFI acknowledges that FSANZ is not empowered to make decisions on the basis of this part of the submission, however it may relay the legitimate concerns of leading industrial hemp companies such as AFI.

These can be summarised for companies like AFI, with its substantial investment in developing hemp foods, as follows: to have positive and legitimate business put aside for legal reasons, it is likewise reasonable that those laws are *functional and effective* in their operation.

AFI notes that there has been controversy surrounding the application of laws related to roadside drug testing in NSW. Specifically, acquittal of a NSW man having detectable levels of THC[3] as the magistrate accepted that THC remained in the body more than a week after smoking. The arresting police officer is reported in the relevant news story as follows:

> *The arresting police officer told the court that "a line had been drawn" and that now you could be "a smoker and not drive, or a driver and not smoke" and that that was the "effect of the new laws".*

This statement reflects a view that detection, rather than impairment, is the basis of application of the relevant law in its current form. A later judgement by the same magistrate directly questioned the validity of drug testing laws[4], reported as follows:

[1] Hemp Oil Canada Inc. (2000), Development of Hemp Food Products & Processes (appended to this document)
[2] Scheifele (2000), Delta 9 THC levels in hemp grain and oil from Northwestern Ontario in 1999 (appended to this document)
[3] www.abc.net.au/news/2016-02-02/man-caught-drug-driving-days-after-smoking-cannabis-acquitted/7133628, accessed 5 August 2016
[4] http://www.abc.net.au/news/2016-03-03/claim-cannabis-stays-in-system-for-up-to-12-hours-questioned/7216720, accessed 5 August 2016

A magistrate has launched a blistering attack on the New South Wales Government's roadside drug testing regime, challenging the accuracy of its claims that cannabis can only be detected in a person's saliva for up to 12 hours.

"In the vast majority of cases the time frame has been over 12 hours," Mr Heilpern said. "On not one occasion has the prosecution cavilled with this contention."

"Not once has any scientific evidence been produced to this court that supports the contention that the final or any other test only works for 12 hours. It could be that every single one of those defendants are lying to the police. However, on balance, I find that this is unlikely."

AFI wishes to clearly and unambiguously state that it does not support users of illicit drugs driving while impaired.

However, we also firmly believe that future use of medicinal cannabis, *which will definitely proceed and mandate only 98% CBD content*, will itself require an adjustment by governments to drug detection procedures that focus on *levels of impairment*, rather than *any detection of THC*. In other words, we believe that the medical community, law community and broader community will not accept that users of medical products that do not impair driving should be in danger of arrest.

Therefore, AFI requests via its submission to FSANZ that the Forum considers the broader implications of THC detection processes, and that any jurisdiction that pursues absolute detection of THC is likely to be subject to successful legal challenge in the foreseeable future.

AFI notes FSANZ does not believe that any impairment through THC ingestion will arise from consumption of hemp seeds, and that further:

Rigorous cleaning methods, including washing, sieving and shelling, may help reduce or remove any cannabinoid contamination of seeds.

As discussed above, AFI welcomes an opportunity to draft an industry code of practice in consultation with FSANZ or other relevant body, where cleaning methods are shown to be beneficial in taking THC levels below agreed thresholds, and to encourage adoption of these practices as required to achieve these threshold levels reliably.

Public Perception of Hemp

AFI is aware of a major shift of public opinion around cannabis-based products following the new-found value of medicinal cannabis. Public awareness in Australia of medicinal cannabis is very strong, in particular the efforts of campaigners such as Lucy Haslam to remove stigma from the use of cannabis has been instrumental in shifting mainstream public opinion. More importantly, campaigners have succeeded in gaining approval for medicinal cannabis use for positive reasons, instead of facing bans and prosecutions from prior legislative approaches.

AFI believes that approval of hemp foods will now add to this positive view of the cannabis plant, rather than detract from it. Both as a source of life-saving medicine and as a source of healthy living food, AFI's view is that the right time has now arrived for Australian and New Zealand governments to legalise hemp food. Furthermore, AFI believes that the respective governments can show leadership in approving a high quality nutritious food source, readily available in overseas markets, long recommended by the FSANZ and now viable for a mature public.

AFI remains ready to provide its expertise in matters related to industrial hemp and hemp foods to FSANZ, the Australia and New Zealand Ministerial Forum on Food Regulation and other government bodies to assist in removing any remaining concerns surrounding hemp food.

[redacted]

Dr Andrew Beehag
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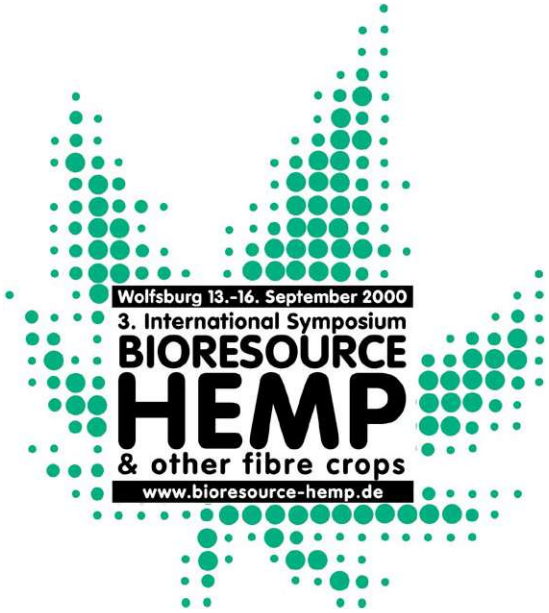
24 August 2016



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Wolfsburg 13.-16. September 2000, nova-Institut (www.nova-institut.de) und Tritec

Delta 9 THC LEVELS IN HEMP GRAIN AND OIL FROM NORTHWESTERN ONTARIO IN 1999

By

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Botanically, the fruit of hemp is a small closed achene or nut containing a single seed. The hemp seed consists of three main parts: pericarp, embryo, and endosperm. The pericarp, called testa, is a very thin, brown membrane when the grain is ripe (with net-shaped veins at maturity) and is visible directly beneath the shell. It tightly encapsulates and protects the embryo and endosperm without a break or seam.

The colour of the ripe hemp nut (shell or hull) is light grey to brown, and often marbled (not a genetic characteristic of the pericarp, but rather represents a coloured imprint of the surrounding bracts at harvesting). The seed hull or shell protects the seed and contains mainly dietary fibre and chlorophyll, which gives hemp oil its green colour. The shell or hull is not a continuous tight covering but has cracks or seams as it envelops the seed. The grain is either spherical or elliptical in shape and measure 2.5-5 millimeters in length and 2-4 millimeters in width. Hemp grain has a thousand-grain weight (TGW) range from 2 to 70 grams. The TGW for grain of common North American varieties ranges from 15-30 grams. The TGW of monoecious varieties is normally lower than that of dioecious varieties.

THC is *delta-9* tetrahydrocannabinol, the major psychoactive chemical compound produced in hemp varieties. The European Community countries and Canada restrict the *THC* levels in cultivated industrial hemp varieties to less than 0.3% in the inflorescence at the time of 50% pollen shed and less than 10 ppm in hemp seed and resulting oil products. *THC* is part of a C21 chemical family called *Cannabinoids*, only found in *Cannabis* plants. These C21 compounds, which consist of the carboxylic acid analogs and transformed products, belong to the chemical class of natural terpenophenols. *THC* is soluble in water – 2.8 mg/ml at 23 degrees C, with a boiling point at 200 degrees C and a molecular weight of 314.47. The presence of Cannabinoids is a dominant inherited genetic characteristic of the *Cannabinaceae* family. More than 300 Cannabinoid and related compounds have been reported as natural constituents of the Cannabis plant.

The glandular secretory system in Cannabis sativa consists of three types of capitate glandular hairs (bulbous, capitat-sessile and capitate stalked) distinguishable by their morphology, development and physiology. These glands occur together in greatest abundance and developmental complexity on the abaxial surface of the bracts. Bulbous and capitate-sessile glands are initiated on very young bract primordia and attain maturity during early stages of bract growth. The capitate stalked glands are initiated later in bract development and undergo development and maturation on medium to full sized bracts

On mature bracts (8-10 mm), capitate-stalked glands with tall multi-cellular stalks are scattered over most of the bract along with the mature capitate-sessile and bulbous glands. Capitate-stalked gland are usually absent along the bract margins.

The exudate of these glandular cells – containing Cannabinoids, accumulates between the cuticle and the membranes of the cells. The exudate is a sticky, brown liquid, with a specific sharp smell. The glands ooze several volatile compounds such as terpenes, ketones and esters which produce the characteristic fragrant “marijuana” odour”, very prominent in the proximity of any hemp field. The production and secretion of Cannabinoids in Cannabis plants is a hereditary genetic characteristic strongly influenced by environment. The highest concentration of secretory glands is found in young leaves and bracts, especially in inflorescence of pistillate plants during flowering.

After seed development and subsequent maturation this exudate which is high (relatively speaking) in THC dries and remains on the bracts. Rains and heavy dews will rinse it onto the hulls or shells of the seed and even penetrate through the cracks and seams of the hull to the testa.

The exudate dust physically contaminates the hemp nut and seed during harvesting (threshing) thereby bringing the presence of THC into hemp seed and oil products. This is presumed to be the major source of physical contamination to the exterior grain. THC levels in any hemp seed or oil products are a major concern in marketing these products. The legal THC limits established by Health Canada is less than 10 ppm for any seed processed products.

The loan of a single spindle Komet cold extraction press from the Indian Agricultural Program of Ontario, gave the Thunder Bay Agricultural Research Station the opportunity to look at some of the issues concerning producing hemp oil with less than 10 ppm THC. Commercial field combine harvest and hand harvested samples were obtained from Thunder Bay Hemp Growers' Association (TBHGA) and Peter Brunner, Dinorwic, Ontario.

Several experiments were conducted to help account for expressed hemp oil resulting with various levels of THC. The following experiments were conducted: 1) lightly rinsing grain with cold water and quick surface drying before expressing oil. 2) Screening grain through a 1/8 inch screen and expressing oil from large seed (>1/8 inch) and small seed (<1/8 inch). 3) Comparing hand harvested to field combined. 4) Comparing varieties. All grain was mechanically cleaned using a fan grain cleaner and was considered to be "very clean". The moisture levels of all the grain was 4-5%, grain temperatures were at about 15-18 degrees C and oil extraction was done at room temperatures of 18 degrees C.

COMPARING OIL FROM WASHED & UN-WASHED GRAIN FOR THC (PPM)

TREATMENT	GRAIN		OIL		MEAN	
	FASAMO	FIN 314	FASAMO	FIN 314	SEED	OIL
WASHED	1.5	2.2	7.7	2.2	1.9	4.9
UN WASHED	4.0	4.5	9.1	12.7	4.2	10.9
%THC in inflorescence*	<0.05	<0.05				

Grain used above was field combine sample from Thunder Bay Hemp Growers' Assoc.
* = % THC in inflorescence at 50% pollen shed.

COMPARING THC LEVELS (PPM) IN OIL EXPRESSED FROM SMALL AND LARGE SEEDS FROM FIELD COMBINE SAMPLES

TREATMENT	FIN 314*	BRUNNER	FASAMO*	MEAN
LARGE (>1/8")	22.9	20.4	6.8	17.0
SMALL (<1/8")	8.3	20.9	7.3	12.0
%THC in inflorescence	<0.05	<0.05	<0.05	

* = Field combine sample from TBHGA. Brunner sample was a composite combine sample.

THC is quite soluble and through the cold press extraction process, most of it is captured in the oil. The oil extraction is about 27% by weight of the grain. Hence expecting a 4-fold increase of THC in the oil compared to the grain is a reasonable "rule of thumb". The results above comparing grain THC levels to extracted oil levels, the ratio varies considerably. The %THC levels for all inflorescence samples harvested at mid pollen shed were all very low, all but one were <0.05%. It appears that low inflorescence THC levels in the summer do not reflect into low THC levels in the

COMPARING THC LEVELS (PPM) IN OIL AND GRAIN FROM DIFFERENT VARIETIES. GRAIN WAS HAND HARVESTED.

TREATMENT	FASAMO*	FEDORA 19*	FELINA 34*	FASAMO	FEDORA 19	MEAN
OIL	21.8	17.5	22.8	9.1	19.1	18.5
GRAIN	7.2	2.0	5.9	4.1	3.4	4.0
%THC in inflorescence	<0.05	0.01	<0.05	<0.05	<0.05	

* = Hand harvested samples from Peter Brunner. All other hand-harvested samples came from TBHGA.

harvested grain or expressed oil. There also appears to be no differences in THC levels between hand and machine harvested grain samples. The hand-harvested samples still need to be threshed, resulting in contamination. Quick rinsing the grain in cold water certainly gave substantially less THC on the resulting grain and expressed oil.

The above results are not based on replicated samples. They do demonstrate the challenges facing commercial processors to consistently produce expressed oil with <10-ppm THC levels. Hemp grain with THC levels higher than 2 ppm should be suspect for producing extracted oil with above 10 ppm THC. Large grain (>1/8 inch) contributed more THC to the expressed oil only from Fin 314. Lower THC levels on Fasamo grain resulted in lower levels of THC levels in the oil (3^{RD} table). Fedora 19 grain had relatively low THC levels coming from two different fields (Brunner and TBHGA) and regions with the resulting oil having very high levels of THC. This relationship was not true for Fasamo. Rinsing the grain with water is possible by passing the rinsed grain through a quick dryer or centrifuge and drier before pressing. The issue then to be dealt with is: "what to do with the rinsate?".

The author suspects that fall weather conditions may contribute significantly to grain contamination with THC as does the mechanical operation of threshing. Periods of rain and drizzle, which are frequent in most regions during the September to October period, will rinse the THC from the bracts onto the nut. The THC levels are the highest on the bracts in the fall at harvest time. It is also suspected that a certain amount of THC will actually by-pass the nut hull or shell and contaminate the testa. Considerable more research needs to be done to verify the sources and time of THC contamination in the field and harvesting of the grain and how to consistently produce a <10 ppm THC contaminated oil.

REFERENCES

Scheifele, G.L., Herb Hinz, and et al. 1998. 1998 Ontario Studies in Determining the Genetic Stability, Environment and Latitude effect on the Levels of *delta-9* THC for Industrial Hemp Varieties. Kemptville College/University of Guelph, Thunder Bay. www.gov.on.ca/omafra (search "Hemp").

Scheifele, G.L. 1998. Determining the Feasibility and Potential of Field Production of Low THC Industrial Hemp (*Cannabis sativa*) for Fibre and Seed Grain in Northern Ontario. Kemptville College/University of Guelph, Thunder Bay. www.gov.on.ca/omafra (Search "Hemp").

Scheifele, G.L. Peter Dragla. 1999. 1999 Report on Environment and Latitude Effect on the THC Levels of Industrial Hemp Varieties Grown in Ontario. Kemptville College/University of Guelph, Thunder Bay. www.gov.on.ca/omafra (search "hemp").

Scheifele, G.L., Peter Dragla. 2000. A Discussion on Cannabis Cannabinoids – THC & CBD. Kemptville College/University of Guelph, Thunder Bay. www.gov.on.ca/omafra (search "hemp").

Development of Hemp Food Products & Processes

An ARDI supported project

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Final Report

Development of Hemp Food Products & Processes

An ARDI supported project - No. 98-209

Project Purpose and Objective

The theory is that hemp seeds do not contain THC, but rather that the seed coats are contaminated by the leaf matter surrounding the seed bud. Our project purpose was to develop processes that would allow us to eliminate and/or reduce the levels of THC presently found in hemp food products and develop a process to sterilize the whole seeds and render them non-viable. Development of various processes would be the key to moving hemp food products from "niche" markets into the main stream for use by value added manufacturers and food processing companies looking to boost the nutritional content of their products.

Our approved project involved researching three particular processes to eliminate and/or reduce the levels of THC:

1. **Develop a process to pre-wash the whole hemp seeds with a chemical or non-chemical agent which would breakdown the THC component and wash it away.**
2. **Develop and improve existing impact hulling processes to accommodate hemp seeds and completely eliminate the contaminated hulls and abnormal seeds through screen separation and air-washing, resulting in a "THC Free" hemp nut (meat).**
3. **Develop various "dry heat" processes to effectively sterilize hemp seeds by utilizing and improving existing grain drying, roasting and microwave technologies.**

***Research note:** In a separately conducted project funded in part by the Manitoba Rural Adaptation Council (MRAC) and Websar Laboratories entitled **"Laboratory Analysis of THC content in Industrial Hemp Seed"**, it was determined that:

"THC is intrinsically found in all parts of the hemp seed, albeit at far lower levels in the hemp seed nut than that found on the seed coats which receive the highest degree of contamination."

With this knowledge, we were able to best focus on methods of reducing these levels of THC versus the complete elimination of such contaminants.

Procedure and Project Activities

1. **Development of a process to pre-wash the whole hemp seeds with a chemical or non-chemical agent which will breakdown the THC component contaminating the hulls and wash it away.**

The development of this process (and the other 2 processes researched) required that the Δ^9-tetrahydrocannabinol (Δ^9-THC) baseline data be collected first from six varieties of industrial hemp seed being grown in Manitoba. The varieties selected included Fedora 19, USO 14, Felina 34, Fin 314, Fasamo and Ferimon 12. The seed analyzed above was first commercially cleaned and conditioned in a seed cleaning plant.

The Δ^9-THC analytical expertise of Websar Laboratories in Ste. Anne, MB., was enlisted to prepare the samples for analysis and determine the Δ^9-THC levels of the six whole seed varieties according to the Health Canada approved protocols for testing Δ^9-THC. The results are summarized in Table 1 below.

With the baseline data in place, the next step was to select one of the six varieties to utilize in the pre-washing process. The German seed variety Fasamo was selected for this purpose.

Numerous cleaning agents were identified, discussed and selected for testing in this study including:

1. **a food grade detergent**
2. **a food grade degreaser**
3. **a super-chlorinated solution called Oxilink used for cleaning contaminated water sources and a second double strength Oxilink solution**
4. **a hydrogen-peroxide solution**
5. **a food grade ethanol/water solution**
6. **water only**

Preparation of the cleaning agent solutions tested above were prepared according to the various manufacturers specifications/instructions. Triplicate samples (10 grams) of Fasamo seed were weighed out for each of the washing trials. The 10 gram sample portion of seed was stirred for 2 minutes, using a stainless steel spatula, in 250 ml of each of the test solutions. The seed was then removed from the cleaning solution and rinsed in 100 ml of HPLC grade water by stirring for 2 minutes with a stainless steel spatula. The seed was then drained and dried in a dehydrator for 30 minutes at 35ºC. The individual samples were then stored in an amber storage bottle until the Δ^9-THC analysis was performed. Duplicate analysis of each sample replicate was performed with the results indicated in Table 2 below.

Project Results & Discussion

Table 1. Δ^9-THC in Whole Hemp Seed – Baseline Data

Variety	Sub-Sample Size (grams)	Sample Size Analyzed (mg)	Δ^9-THC Range (μg/g)	Δ^9-THC Level (μg/g)
Fedora 19	10.0	200	2.19 – 2.96	2.53
USO 14	10.0	200	0.40 – 0.66	0.54
Felina 34	10.0	200	2.15 – 2.84	2.55
Fin 314	10.0	200	2.17 – 3.05	2.57
Fasamo	**10.0**	**200**	**2.19 – 2.79**	**2.46**
Ferimon 12	10.0	200	2.62 – 4.66	3.57

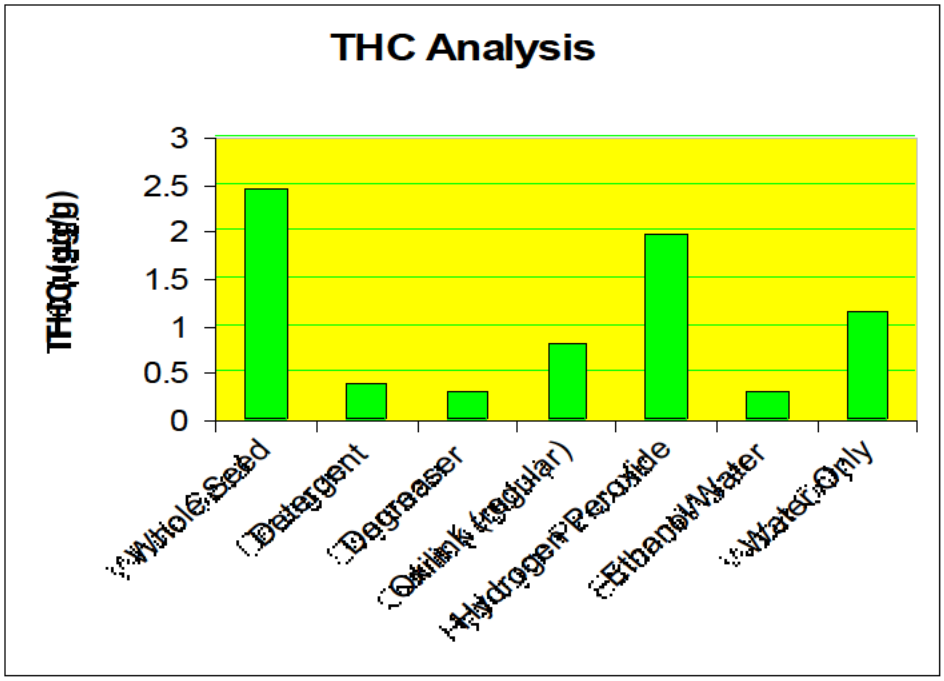
* Fasamo seed was selected to utilize in the pre-washing solution tests. Note: the allowable limit by Health Canada for any hemp seed derivative is 10 μg/g (parts per million). All varieties tested for the baseline data were within this range.

Table 2. Results of Δ^9-THC levels after cleaning in test solution

Test Solution	N	Δ^9-THC Range (μg/g)	Average Δ^9-THC Level (μg/g)
Fasamo whole seed (baseline)	**3**	**2.19-2.79**	**2.46**
Food grade detergent	3	0.39-0.43	0.41
Food grade degreaser	3	0.28-0.32	0.30
Oxilink (regular strength)	3	0.76-0.82	0.80
Oxilink (double strength)	1	5.01-6.06	5.54
Hydrogen-peroxide	3	1.76-2.19	1.98
Food grade ethanol/water	3	0.27-0.35	0.31
Water only	3	1.11-1.28	1.17

n = number of replicates. Each replicate consists of a duplicate analysis of the sample.

A bar chart of the result in Table 2 is shown on the following page.



Note: The results from the double strength Oxilink test were not included above. It was postulated that this solution may have caused oxidation of the CBD also present on the seed coat which turns it into Δ^9-THC, thus increasing the level of Δ^9-THC as compared to the baseline data for the whole seed.

Conclusions

The results of pre-washing the whole seeds in the various solutions proved that the levels of Δ^9-THC contaminating the seed coats could indeed be significantly reduced from 20% up to 88%.

The most interesting observation is that a simple pre-wash of the seeds in water only was also relatively as effective as any of the other solutions tested. The use of water as a pre-wash would obviously be the most economical cleaning agent to utilize. However, the study did not address the advantages of each test solution being utilized also as an agent to rid the seed of any microbial food contaminants.

From purely a cost perspective to reduce the levels of Δ^9-THC, the use of a food grade detergent or degreaser was most effective.